Supplemental Environmental Analysis
For Purposes of
2003-2004 Dredging
(Lower Snake and Clearwater Rivers, Washington and Idaho)

ATTACHMENT B

Sampling and Quality Assurance Project Plan

Physical and Chemical Characterization of the Sediments in Areas of the Lower Snake River Proposed for Dredging in 2003/2004

Prepared by:
U.S. Army Corps of Engineers
Walla Walla District
Walla Walla, Washington

April 2003

Abstract

A sampling and analysis program for evaluating sediments in proposed dredging areas is presented. Ten units located between the reach below Ice Harbor Dam to the Swallows Boat Basin on the lower Snake River and in the first 1.5 mi up the Clearwater River are considered. One in-reservoir disposal site in Lower Granite Reservoir is slated to receive the material as part of a fish habitat enhancement program. Samples will be collected with either a 3-in Balchek or Shipek sampler. A maximum of 68 samples will undergo sieve analysis, although the number may be less due to the anticipated cobble/gravel substrate previously identified in many areas. Other analyses that would be completed on a subset of the samples include ammonia, trace metals, mercury, oil and grease, TPH, chlorinated herbicides, organophosphorus pesticides, semi-volatile herbicides and pesticides, PAHs, PCBs,total organic carbon and total volatile solids. A smaller subset of samples collected in Lower Granite pool will be screened, and possibly further analyzed, for dioxin. All samples will be analyzed consistent with QA-1 standards and the final data set will be input into SEDQUAL.

Contents

Figures

Tables

Appendices

1.0 BACKGROUND

Sediment samples have been collected from various locations within the lower Snake River project since at least 1985. A summary of the physical and chemical characteristics is presented in the Final Dredged Material Management Plan (DMMP) and Environmental Impact Statement (USACE, 2002). More detailed information regarding specific studies can be found in Anatek (1997), CH2M Hill (2000, 1999, 1997), USACE (2002a, 2002b, 1998, 1987), Crecelius and Cotter (1986), Crecelius and Gurtisen (1985), HDR (1998), and Pinza *et al*. (1992).

Most of the studies dealing with sediment quality have described the sediment as very rich in nitrogenous compounds. The dominant species is ammonia with concentrations averaging 60 to 80 mg/L.

The organic analytes that were evaluated during the most recent survey using EPA test methods included semi-volatile compounds (8270C), dioxins and furans (8290), herbicides (8141), organophosphate pesticides (8151A), oil and grease (9071), and glyphosate (547). Some dioxin and furan congeners were detected but at 100 times below the Puget Sound Disposal bioaccumulation trigger. Glyphosate was present in many samples but did not exceed drinking water standards. PAH compounds were also identified but none of them were found to exceed the screening limits.

Twenty-one elemental metals were also examined using EPA method 6020 in 2000. For the metals that had screening and bioaccumulation limits, all results were below the recommended screening values. Manganese does not have a screening criterion under the interim protocols used but high concentrations were identified throughout the entire lower Snake River. Laboratory detection limits for mercury were very close to the bioaccumulation trigger but none of the samples evaluated for the previously planned 2002/2003 dredging program had detectable concentrations. The arsenic results from the 2000 study were not usable, but Tier I data indicated that the average concentrations were ten times below the screening limit.

Elutriate tests were also completed in 1997 at simulated ambient pH conditions. These evaluations were used to determine which inorganic or organic constituents would preferentially partition by dissolution into the water and their potential aqueous concentrations. No organochlorine pesticides were identified in any of the elutriate samples. The only organophosphorus pesticide detected was ethyl parathion in one sample at a concentration of 1.0 ppb, in spite of the fact that it was not detected in any of the sediment samples. Glyphosate was detected in only two of the 94 samples at concentrations of 0.69 µg/L and 0.58 µg/L in samples collected from Lake Bryan and Lake Sacajawea, respectively. Barium and manganese were the predominant metals detected. The average concentration of barium increased from 83.3 ppb for the Lower Granite Lake samples to 243.6 ppb for the Lake Sacajawea samples. Manganese concentrations similarly increased downstream ranging from 504 ppb for the samples collected from Lower Granite Lake to 1,432 ppb for the samples collected from Lake Herbert G. West. The 2002 DMMP report also indicated that the maximum concentrations of arsenic, copper, manganese, and mercury could exceed applicable water quality

standards when re-suspended during dredge operations. Of the eighteen metals evaluated, only beryllium, silver, and thallium were not detected in the elutriate samples. Average elutriate ammonia concentrations ranged from 2.5 mg/L in Lake Herbert G. West to 3.6 mg/L in Lake Sacajawea and Lower Granite Pool.

2.0 PROJECT DESCRIPTION

The proposed areas to be dredged range from about river mile (RM) 9 to RM 142.5 on the lower Snake River, as well as up to about RM 1.5 on the Clearwater River. A total of thirteen potential dredge sites have been identified, with removal quantities ranging from approximately 1,000 yd^3 to 250,000 yd^3 (Table 1). The areas associated with the Ports of Clarkston and Lewiston are optional at this time – the Ports will advise the USACE regarding their decision to dredge or not dredge prior to commencement of the navigation channel work. One in-reservoir disposal site is currently considered. This site is on the

Table 1. Proposed 2003-2004 dredging areas, estimated quantity to be dredged from each region, and anticipated number of sample sites.

DESIGNATION	AREA	QUANTITY TO BE DREDGED (YD^3)	REACH (APPROX. RIVER MILE)
Dredge Site	Swallows Park Boat Basin	5,000	SNR 142
	Swallows Park Swim Beach	11,000	"
	Greenbelt Boat Basin	2,800	SNR 139
	Port of Clarkston Gateway Dock (optional)	9,600	"
	Port of Clarkston Grain Terminal (optional)	1,460	SNR 138
	Port of Clarkston Crane Dock (optional)	Not determined	SNR 138
	Port of Lewiston Berthing Areas (optional)	5,100	CLW 1.2
	Federal Navigation Channel at Confluence of Snake and Clearwater Rivers	250,500	SNR 138 – CLW 1.5
	Lower Granite Navigation Lock Approach	4,000	SNR 107
	Illia Boat Launch	1,400	SNR 104
	Willow Landing Boat Launch	6,200	SNR 88
	Lower Monumental Navigation Lock Approach	20,000	SNR 41
	Ice Harbor Navigation Lock Approach	5,112	SNR 9
In-Reservoir Disposal	Near-shore on left bank	N/A	SNR 116-117

left bank near RM 116.5 where the water depth is less than 40 ft. One criterion, and consequently also one of the goals, for site selection was to identify a region where it was possible to enhance available fish habitat.

Several of the proposed dredging regions identified in this plan were last sampled in 2000. As such, the primary objectives of this study are to:

- Update previous data to account for new sedimentation.
- Obtain a better understanding of the current chemical characteristics of the sediments within proposed dredging areas in the lower Snake River.
- Compare this information to historical data from the same locations.
- Determine the suitability of the dredge material for in-reservoir disposal.

3.0 RESPONSIBILITIES

ROLE	NAME	PHONE	E-MAIL
Project Manager	Jack Sands	509-527-7287	Jack.D.Sands@nww01.usace.army.mil
Principal Investigator	Russ Heaton	509-527-7282	Russ.D.Heaton@nww01.usace.army.mil
Field QA/QC Officer	Phil Fishella	509-527-7279	Philip.J.Fishella@nww01.usace.army.mil
Field Collection	OA Systems Eugene Ralston	541-490-2158	glralston@mindspring.com
Laboratory Analyses	1° Contract lab	Contract not awarded at this time	
SEDQUAL Data Entry	1° Contract lab Paul Good	Contract not awarded at this time 509-527-7290	Paul.H.Good@nww01.usace.army.mil

4.0 SCHEDULE

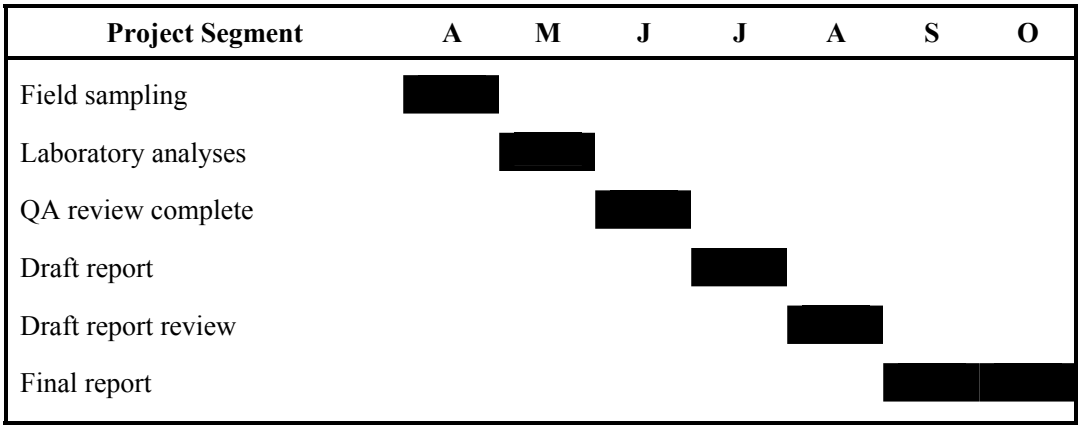

Figure 1. Tentative schedule for the field sampling through final report phases of the project

5.0 SAMPLING DESIGN

Several guidance documents were considered during the development of this plan. These reports included those by Lombard and Kirchmer (2001), USACE (1994), and USACE (1998).

The 2003 sediment-sampling program will focus on areas of the Clearwater River and lower Snake River where dredging, as well as in-reservoir disposal, is anticipated to occur. The goal is to revisit sites that were sampled in 2000 (Appendix A, Table A-1) where possible. This approach will facilitate construction of a long-term database specific to sediment quality that can be used in the future for spatial and temporal analyses. Previous locations that were outside the proposed 2003/2004 dredging areas were not included in this plan. However, additional locations were added within the dredge zones to ensure a thorough characterization and the revised list is presented in Appendix A, Table A-2. Maps of each sediment management unit and the associated sample sites are shown in Figures 2 through 15 (see attached files or illustrations).

The proposed number of sample locations, duplicates, split samples, and equipment blanks for each area are summarized in Table 2. More details are provided in Appendix A, Table A-2 and Appendix B, Table B-1 as well as section 8.1.

Table 2. Proposed 2003-2004 dredging areas, number of regular, duplicate, split, and equipment blank samples.

DESIGNATION	AREA	REGULAR	DUPLICATE	SPLIT	EQUIPMENT BLANK
Dredge Site	Swallows Park Boat Basin and beach	4	1		1
	Greenbelt Boat Basin	6	2	1	1
	Port of Clarkston (optional)	6			
	Port of Lewiston (optional)	3			
	Federal Navigation Channel at Confluence of Snake and Clearwater Rivers	27	4	1	2
	Lower Granite Navigation Lock Approach	3			
	Illia Boat Launch	2	1		1
	Willow Landing Boat Launch	3	1	1	1
	Lower Monumental Navigation Lock Approach	3			
	Ice Harbor Navigation Lock Approach	8	1		
In-Reservoir Disposal Site	Near-shore on left bank	3	1	1	1

6.0 FIELD PROCEDURES

6.1 SAMPLING LOCATIONS AND PARAMETERS

Each sampling location is identified by approximate Washington State plane coordinates and river mile location (Appendix A, Table A-2). The stations will be located and positions recorded during the fieldwork using a differentially corrected global positioning system (DGPS) using NAD27 as the reference. Where appropriate, positions relative to fixed onshore structures or features will also be recorded in the field notebook maintained during sampling.

6.2 SAMPLE EQUIPMENT PREPARATION

All core sampling tubes, core catchers, dredges, mixing bowls, spoons, and related tools that contact the sediment will be thoroughly cleaned prior to use. Pre-cleaning prior to initiating work at a sediment management unit consists of washing with Liquinox or Alconox detergent, followed by sequential rinses with tap water, dilute (10%) reagent grade H_2SO_4 or HCl acid, de-ionized or distilled water, hexane, and finally with de-ionized water again. The equipment will then be air-dried and wrapped in aluminum foil, or protected in a sealed box, until used in the field. Cleaning between successive sampling stations within a designated area will consist of thoroughly washing with on-site water. If oil or visible contamination is encountered on the sampling equipment they will be cleaned with a detergent wash followed by a rinse with on-site water.

Back-up sampling equipment and containers will be available at all times. These items can be on the boat if room permits or in a nearby vehicle for convenience.

6.3 SEDIMENT SAMPLING

Sediment sampling will be completed using a spud sampler, 3-in Balchek sampler, or a Shipek sampler. The spud sampler will be used initially to determine the approximate sediment size (cobbles and gravel versus fines). If no sample is collected, the boat will be moved a minimum of 10 feet and the area re-sampled. The same procedure will be followed if the differences between the coordinates provided in Appendix A, Table A-2 and the accuracy of the DGPS equipment results in a site being located on the shore or dock. If a spud sample is recovered and it is greater than one foot thick, the Balchek sampler will be used to collect sufficient sample. If it is less than 1-ft long, the Shipek sampler will be utilized. In the event that more than one core is needed from a given location to obtain enough material for laboratory testing, multiple cores will be composited as outlined in Section 6.6. Care will be taken while operating the vessel in shallow water near the shore so as not to disturb the sediments being sampled.

6.4 FIELD EVALUATION OF SAMPLES

Once the sampler is brought back onboard the survey vessel, the contents of the sampler will be visually examined. If the sample contains primarily cobble and gravel material then it will not be forwarded to the laboratory. However, a digital photo of the sample, along with a ruler and identification number will be taken for documentation. If the grab material is predominantly smaller than gravel then it will be considered acceptable if (a) the sampler is not over-filled with sediment, (b) overlying water is present and not excessively turbid, (c) the sediment surface is relatively flat, and (d) the desired penetration has been achieved.

6.5 DOCUMENTATION

A chronology of all relevant field activities including, but not limited to, coring, field screening, sample collection, and cleaning activities will be documented. As dredge or core samples are taken, the field data sheet in Appendix C will be completed using waterproof ink and placed in a binder. A separate waterproof sheet provided by the U.S. Army Corps of Engineers (USACE) will be used for each sample. A permanently bound field logbook (e.g., Rite 'n Rain) will be used for additional documentation or notes if needed. All notebook entries will be made with indelible ink and a new page will be used for each day of sampling. Drawing a line through the entries and initialing them will be standard protocol when making corrections. All notebooks, binders, chain of custody forms, and shipping copies will be submitted to the USACE at the end of the project.

6.6 COMPOSITING SAMPLES

The sediment samples retrieved at each target location that do not consist primarily of cobble or gravel will be composited. This task consists of placing the material in a large stainless steel bowl and mixing the contents with a stainless steel spoon until the mixture is homogeneous. Stirring will continue while individual samples are removed and placed in the appropriately sized and labeled sample containers (Table 3).

6.7 SAMPLE PACKAGING AND SHIPPING

Immediately following the compositing of the sediment, a sample label will be applied to the sample container. The labels will be provided by the USACE and provide information such as:

- Project ID
- Sample name.
- Date and time of collection.
- Field crew identification
- Sample site, type, and requested analyses.
- Preservative used, if any.

Table 3. Recommended containers and field preservation techniques for the sediment samples.

ANALYSIS	CONTAINER[1]	PRESERVATION
Sieve analysis	1-L PE	4 °C
Total volatile solids, total organic carbon, TPH, NH_3, NO_2+NO_3, TOC	500-mL G TEF	4 °C
Oil and grease	250-mL G TEF	4 °C
Pesticides, herbicides, PCBs, PAH	500-mL G TEF	4 °C
Arsenic and metals	125-mL G TEF	4 °C
Total mercury	125-mL G TEF	4 °C
Dioxin screen	125-mL G TEF	4 °C
Dioxin GCMS	125-mL G TEF	4 °C
[1] EPA certified containers will be provided by the contractor.		

Additionally, the sample identification number will be written on the container lid in waterproof ink as a secondary label in case the primary one is damaged.

The samples will be placed in an ice chest packed with ice immediately after processing. The majority of the samples will be kept at a temperature as close to 4 °C as possible from the time of collection to the time of delivery at the laboratory. Samples will be packaged for shipment to the analytical laboratory as follows:

- Attach sample label to each container.
- Secure caps and write identification information on lid.
- Wrap glass sample containers in bubble wrap or other packaging material.
- Place containers in plastic Zip-lock bags.
- Pack ice around the samples in the ice chest.
- Complete chain of custody form for the samples in a given ice chest.
- Wrap, seal, and tape the form to the inside lid of the ice chest.
- Tape the ice chest drain and lid shut to prevent accidental opening during shipping and handling.

The exceptions to this procedure are the samples designated for dioxin screens. These containers will be frozen at the Walla Walla District (NWW) office, or at an intermediary lab, and sent to the analytical laboratory packed in dry ice.

7.0 LABORATORY PROCEDURES

7.1 LABORATORY ANALYSES

Sediment samples will be analyzed in accordance with the testing procedures outlined in Figure 16. Samples that consist of material smaller than cobble or gravel will be sieved and analyzed for total

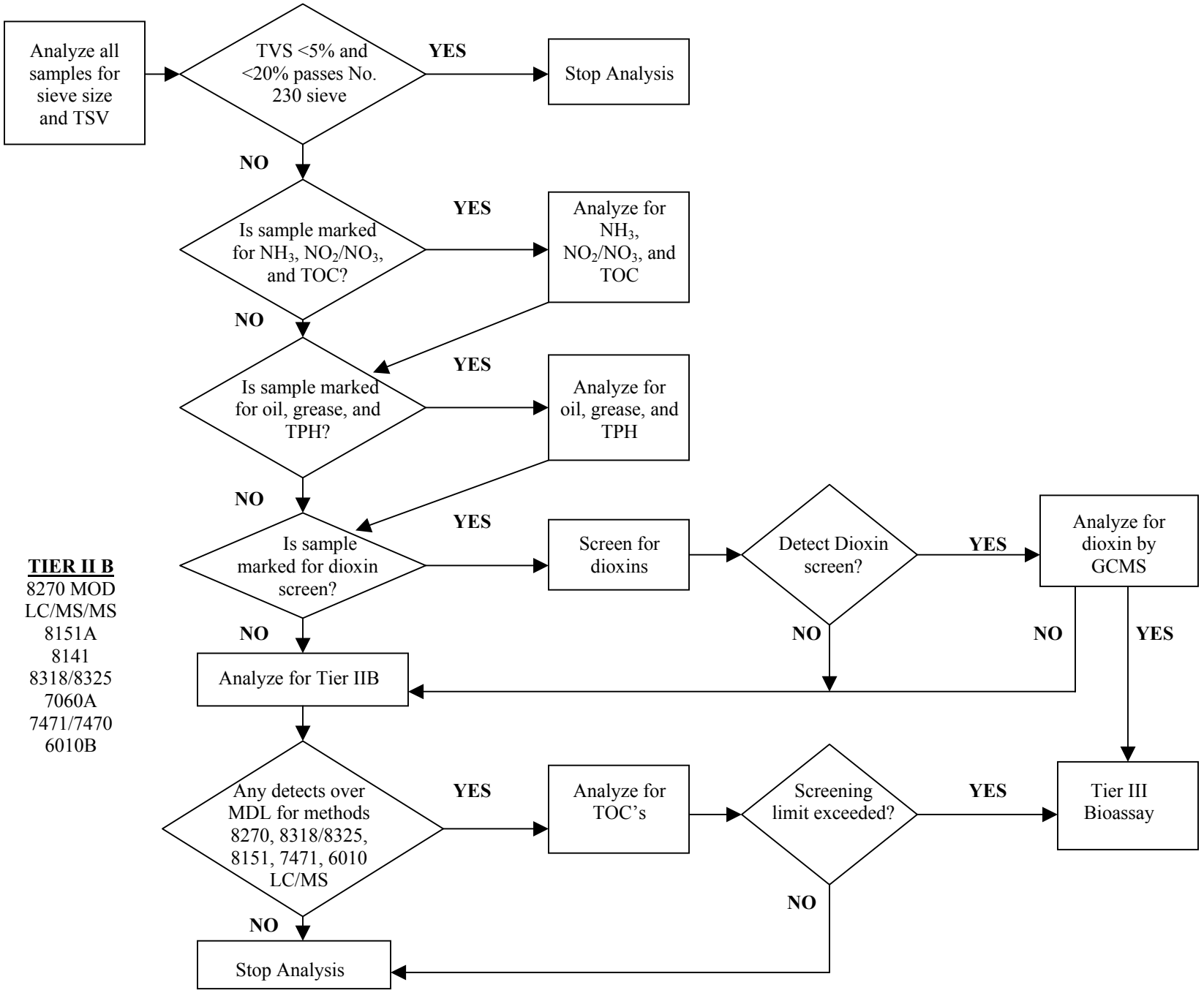

Figure 16. Analytical flow chart.

volatile solids (TVS). If the sample has greater than 5% TVS and more than 20% passes a No. 230 sieve, then it will be analyzed for Tier IIB analytes. The parameters slated for this level of analysis include metals, semi-volatile organics, pesticides, herbicides, PAHs, and PCBs. Based on the results of previous sampling events, dioxin screens will be used only on samples collected from Lower Granite pool. If the screen (EPA 4425) indicates the presence of dioxin then a complete dioxin analysis (EPA 8290) will be performed. Except of samples submitted for dioxin screening, any sample testing positive for organics will be analyzed for total organic carbon (TOC). Sediment collected from boat basins, port areas, and tugboat turning areas will be analyzed for oil, grease, and TPHs.

The recommended analytical methods, holding times, and instrument detection limits are provided in Appendix D, Tables D-1 and D-2 (compounds evaluated in 2000 are shaded yellow and new inclusions have a magenta font). A total of thirteen sieves are required: US standard numbers 230, 200, 100, 50, 30, 16, 10, 8, 4, as well as 0.375-, 0.75-, 1.5- and 3-inch sieves. The particle size distribution obtained from the sieve analysis will be correlated to percent fines, percent sand and percent gravel, where:

- Percent fines equals sediment passing through a 230 sieve (< 63 μm).
- Percent sand encompasses the 63 μm to 2 mm sized material.
- Percent gravel materials > 2 mm.

8.0 QUALITY CONTROL PROCEDURES

8.1 Field Quality Control and Quality Assurance

Additional QA/QC samples will be collected in the field in association with the execution of this sampling and analysis plan. Sample types include duplicates, split samples, and equipment blanks:

- Duplicate samples will be collected at a rate of at least ten percent of the sample locations. If the stations designated for replicate sampling in Appendix A, Table A-2 cannot provide sufficient volume, then alternatives can be substituted. Duplicate samples will be submitted to the laboratory as a new sample location using the sample site numbers identified in Appendix A, Table A-2. The sample site location name utilized will correlate with the dredge area where the sample was collected.
- Split samples will also be collected at the four locations identified in Appendix A, Table A-2 and sent to a separate laboratory for the appropriate analyses.
- Washing the samplers with de-ionized water and submitting the water to the laboratory for the same chemical analyses prescribed for the sediments will constitute an equipment blank. A total of seven equipment blanks will be collected at the locations specified in Appendix B, Table B-1.

8.2 Laboratory Quality Control

Laboratory quality control will follow the protocols prescribed for QA-1 (PTI, 1989). In general, QA-1 describes the QA/QC activities and objectives applied to sediment projects when the chemistry data will be submitted to the Washington Department of Ecology. The quality control chemistry samples to be analyzed

and associated with the sediment samples are listed in Appendix D, Table D-2. The necessary chemistry QC recovery limits are listed in Appendix D, Table D-3 while the acceptance levels are presented in Table D-4.

8.3 Corrective Actions

The USACE field QA/QC officer will work collaboratively with the contractors. His efforts will focus on insuring that QA/QC procedures are adhered to, advise on what course of action to pursue if difficulties arise, and facilitate transport of the sample containers to the designated laboratories.

The laboratory analysts are responsible for monitoring the analyses, as well as troubleshooting problems as they occur. It is important for these individuals to identify problems as soon as possible so that corrective actions can be taken prior to the expiration of holding times. It is the responsibility of the laboratory to communicate difficulties encountered to the principle investigator so he may have input into the course of corrective action. This communication is critical if the laboratory experiences any difficulty meeting specific project requirements, including detection limits. Additionally, it is important for the principal investigator and laboratory to agree on what constitutes a reasonable corrective action.

8.4 Data Review and Validation

The field and laboratory data will be reviewed and validated via parallel tracks (Figure 17). The prime contractors for each component will ensure that:

- Standard field operating procedures were followed.
- Laboratory minimum detection limits were met.
- Instrument blanks, spikes, and references sample results were within acceptable limits.
- The data are complete and reasonable.

Once the data have been reviewed, verified, and validated, the USACE principal investigator will make a determination if the data can be used to make the decisions the project was designed to answer. If the results are satisfactory, appropriate data analysis tools will be used to evaluate between-site differences and the appropriateness of using the material for in-reservoir disposal.

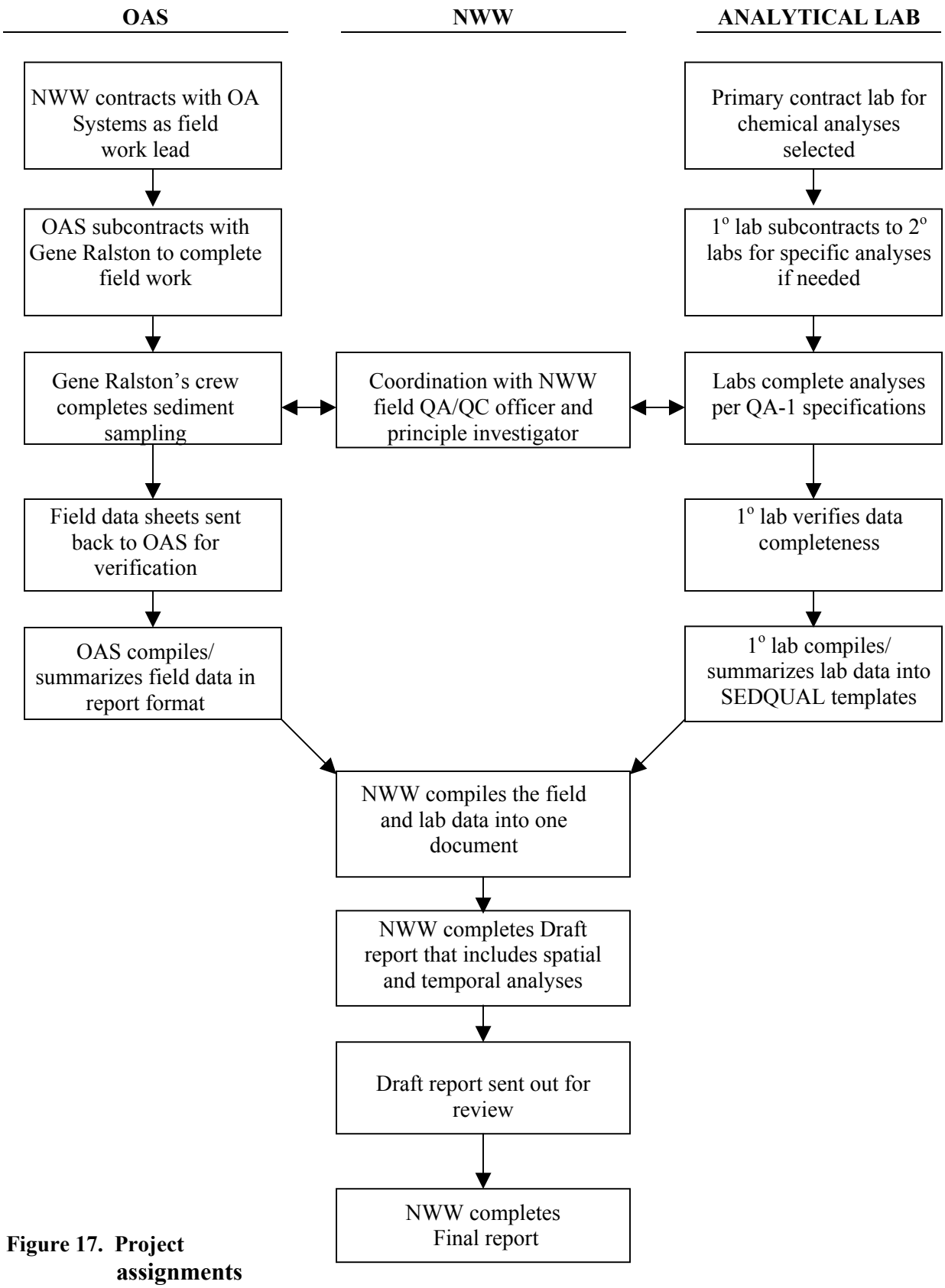

Figure 17. Project assignments

9.0 REPORTING

The primary field and laboratory contractors, as well as Walla Walla District personnel, will complete reports. The two prime contractors will compile their respective data sets after completion of the data review and validation process. The report prepared by the field contractor will summarize that segment of the program and identify any problems encountered. The final product (i.e., report and data) will be provided to Walla Walla District in MS Word and/or Excel format, as well as a hardcopy. The primary laboratory contractor will report all of the chemistry data resulting from the sample analyses following the QA-1 guidelines. The final QA-1 report will contain the following information and deliverables:

- A QA-1 narrative discussing data quality in relation to site objectives and data qualification criteria (data qualifier codes are listed in Appendix D, Table D-5).
- A summary of all associated QC data.
- A comprehensive report containing all qualified analytical data.

In addition to this report, the laboratory contractor will also enter the analytical data into SEDQUAL templates and deliver them to the USACE in electronic format. The USACE, if requested, will provide a copy of the SEDQUAL data entry manual information to the contractor; the contractor should coordinate this effort with the USACE principle investigator. The acceptable loadable template format for SEDQUAL includes:

- CSV (comma delimited) Excel format with 16 fields. Each field reported (e.g., survey code, station ID number, and sample date) must not exceed the maximum number of characters.
- Some fields require reporting with specific codes.
  - ✓ Analytes (chemical names) to be reported from SEDQUAL chemical dictionary codes.
  - ✓ Sample analysis codes to be reported from SEDQUAL analysis table codes.
  - ✓ Concentration to be reported from Concentration unit table.
  - ✓ Measurement basis from Measurement basis code table.
  - ✓ Qualifier code, Sample treatment and QA levels to be reported according to table code format.
- Total organic carbon will be reported in percent not normalized for carbon.
- Particle size will be reported in percent gravel, percent sands and percent fines to at least two decimal places. The breakdown for the amount of material passing individual sieves will be provided in the same manner.
- Total solids are to be reported as parts per million wet weight.
- Dates are to be reported in Y2K format.

The principal investigator, in consultation with other USACE staff, will prepare a draft report on the results of the sediment sampling during June 2003. This report will contain:

- Maps of the proposed dredge regions showing all sampling sites.
- Descriptions of field and laboratory methods
- Sample information (dates, times, depths, GPS coordinates, etc.)
- Discussion of data quality and the significance of any problems encountered in the sampling or analysis.
- Summary tables of all chemical data.
- An analysis of the spatial and temporal patterns identified in the data set.
- Comparisons with other applicable information on typical chemical characteristics of freshwater sediments and available sediment quality guidelines.
- Recommendations for follow-up work.

It is anticipated that the final project report will be completed by October 2003.

10.0 REFERENCES

Anatek Labs. 1997. *Lower Snake River Feasibility Study. Sediment Quality Study Analytical Results*. Moscow, Idaho.

CH2M Hill. 2000. *1999 Ambient Sediment Monitoring Report*. Potlatch Lewiston Complex. Prepared by CH2M Hill, June 9, 2000

CH2M Hill. 1999. *1998 Ambient Sediment Monitoring Report*. Potlatch Lewiston Complex. Prepared by CH2M Hill, June 9, 1999.

CH2M Hill. 1997. *Sediment Sampling Particle Size Sampling Task.* July 1997.

Crecelius, E.A., and O.A. Cotter. 1986. *Sediment Quality of Proposed 1987 Dredge Site, Lewiston, Idaho*. Prepared for the U.S. Army Corps of Engineers, Walla Walla District, August 1985.

Crecelius, E.H., and J.M. Gurtisen. 1985. *Sediment Quality of Proposed 1986 Dredge Sites,Clarkston, Washington*. Battelle Marine Sciences Laboratory, Sequim, Washington. Report Number PNL-5552 UC-11.

HDR. 1998. *Sediment Sampling Lower Snake River and McNary Pool*. Field Documentation and Particle Size Data. For the U.S. Army Corps of Engineers, Walla Walla District, October, 1998.

Lombard, S.M. and C.J. Kirchmer. 2001. *Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies*. Environmental Assessment Program, Washington State Department of Ecology. Publication Number 01-03-003. Manchester, Washington.

Pinza, M. R., J.A. Word, L.F. Lefkovitz, and H.L. Mayhew. 1992. *Sediment Sampling of Proposed Dredge Sites in the Confluence of the Snake and Clearwater Rivers*. Battelle Marine Sciences Laboratory, Sequim, Washington. Report Number PNL-7958 UC-000.

PTI. 1989. *Puget Sound Dredged Disposal Analysis Guidance Manual. Data Quality Evaluation for Proposed Dredged Material Disposal Projects (QA-1).* Prepared for Washington Department of Ecology (Ecology Contract C0089018) by PTI Environmental Services Bellevue, Washington.

USACE. 2002a. *Final Lower Snake River Juvenile Salmon Migration Feasibility Report/ Environmental Impact Statement*. Appendix H, Water Quality. U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, Washington.

USACE. 2002b. *Final Dredged Material Management Plan and Environmental Impact Statement (DMMP/EIS), McNary Reservoir and Lower Snake River Reservoirs*. U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, Washington.

USACE. 1998. *Dredged Material Evaluation Framework: Lower Columbia River Management Area*. Prepared with the cooperation of the USEPA Region 10, Washington State Department of Ecology, Oregon Department of Environmental Quality, and the Washington State Department of Natural Resources. U.S. Army Corps of Engineers, Portland District, Portland, Oregon.

USACE. 1994. Requirements for the Preparation of Sampling and Analysis Plans. Manual Number 200-1-3. U.S. Army Corps of Engineers, Washington DC.

USACE. 1987. *Final Environmental Assessment. Proposed Lower Granite 1988 Interim Flood Control Dredging, Lower Granite Lock and Dam Project*. U.S. Army Corps of Engineers, Walla Walla District, Walla Walla, Washington.

Appendix A

Sediment Sampling Sites

Table A-1. 2000 sediment sampling locations and material composition

Sample Site Name	Pool Location	Location Name	Approx WA State Plane Easting NAD27	Approx WA State Plane Northing NAD27	River Mile	Composition
HLDLA-1	Ice Harbor	Lower Monumental Nav Lock Approach	2491767.10	452131.31	41.00	Cobbles
HLDLA-2	Ice Harbor	Lower Monumental Nav Lock Approach	2492364.69	452601.00	41.00	No recovery
HLDLA-3	Ice Harbor	Lower Monumental Nav Lock Approach	2492919.39	453036.99	41.00	No recovery
LGO-87.9H2	Little Goose	Willow Landing	2690069.17	504310.96	87.90	Brown silty clay
LGO-87.913	Little Goose	Willow Landing	2690194.76	504210.48	87.90	Black/grey silty clay
LGO-87.912	Little Goose	Willow Landing	2690392.12	504167.42	87.90	“
LGO-87.911	Little Goose	Willow Landing	2690542.83	504110.01	87.90	“
LGO-103.7J1	Little Goose	lllia Landing	2760138.91	511781.91	103.70	Grey/brown silty clay
LGO-103.7J2	Little Goose	lllia Landing	2760232.21	511746.02	103.70	“
LGOLA-1	Little Goose	Lower Granite Nav Lock Approach	2768848.82	500596.89	107.00	6” cobbles
LGOLA-2	Little Goose	Lower Granite Nav Lock Approach	2769459.74	500215.17	107.00	3-4” cobbles
LGOLA-3	Little Goose	Lower Granite Nav Lock Approach	2769921.65	499926.55	107.00	1” cobbles
LGR-137.2D3	Lower Granite	Redwolf Marina	2864143.70	415940.62	137.20	Black/grey silty sand
LGR-137.2D2	Lower Granite	Redwolf Marina	2864147.45	415851.86	137.20	Black/grey silty clay sand
LGR-137.2D4	Lower Granite	Redwolf Marina	2864156.95	415734.82	137.20	Black/grey silty sand
LGR-137.3D	Lower Granite	Redwolf Marina	2864186.76	416019.57	137.20	Black/grey sandy silt
LGR-138.1A	Lower Granite	Lewiston/Clarkston	2867244.03	419087.61	138.10	No recovery
LGR-138.1B	Lower Granite	Lewiston/Clarkston	2867322.98	418879.48	138.10	“
LGR-138.1C	Lower Granite	Lewiston/Clarkston	2867416.27	418671.36	138.10	1-3” cobbles
LGR-138.1D	Lower Granite	Lewiston/Clarkston	2867466.51	418420.17	138.10	Brown/black course sand
LGR-138.4G	Lower Granite	Lewiston/Clarkston	2868729.61	417924.98	138.40	Black fine sand
LGR-138.4F	Lower Granite	Lewiston/Clarkston	2868743.96	418111.58	138.40	Brown/grey course sand
LGR-138.4E	Lower Granite	Lewiston/Clarkston	2868772.67	418355.58	138.40	“
LGR-138.7F	Lower Granite	Lewiston/Clarkston	2870107.54	418018.28	138.70	“
LGR-138.7E	Lower Granite	Lewiston/Clarkston	2870164.95	418276.64	138.70	“

Table A-1. 2000 sediment sampling locations and material composition (continued).

Sample Site Name	Pool Location	Location Name	Approx WA State Plane Easting NAD27	Approx WA State Plane Northing NAD27	River Mile	Composition
LGR-138.7D	Lower Granite	Lewiston/Clarkston	2870243.89	418570.88	138.70	"
LGR-138.9H	Lower Granite	Lewiston/Clarkston	2871377.81	418075.69	138.90	"
LGR-138.9G	Lower Granite	Lewiston/Clarkston	2871506.99	418290.99	138.90	"
LGR-138.9F	Lower Granite	Lewiston/Clarkston	2871657.70	418585.24	138.90	No recovery
LGR-139.1I	Lower Granite	Lewiston/Clarkston	2872368.20	417408.26	139.10	Brown/grey fine sand
LGR-139.1H	Lower Granite	Lewiston/Clarkston	2872504.56	417587.68	139.10	"
LGR-139.1G	Lower Granite	Lewiston/Clarkston	2872597.85	417759.92	139.10	1-5" cobble
LGR-139.1F	Lower Granite	Lewiston/Clarkston	2872719.86	417975.22	139.10	Brown/grey fine sand
LGR-139.2F	Lower Granite	Lewiston/Clarkston	2873215.05	417551.79	139.20	No recovery
LGR-138.9I	Lower Granite	Port of Clarkston	2871270.16	417903.45	138.90	"
LGR-139.2El	Lower Granite	Green Belt Boat Basin	2872920.90	417243.19	139.20	No recovery
LGR-139.1J	Lower Granite	Green Belt Boat Basin	2872253.37	417178.60	139.10	Brown/grey silty sand
LGR-139.3L	Lower Granite	Green Belt Boat Basin	2872798.80	416837.71	139.30	Black silty sand
LGR-139.3El	Lower Granite	Green Belt Boat Basin	2872898.55	416595.36	139.30	Brown/grey silty sand
LGR-139.3E2	Lower Granite	Green Belt Boat Basin	2873968.60	417523.09	139.30	"
LGR-139.4E3	Lower Granite	Green Belt Boat Basin	2872967.38	416432.27	139.40	
LGR-139.4El	Lower Granite	Green Belt Boat Basin	2872988.45	416141.57	139.40	Black/grey clay sand
LGR-139.4E2	Lower Granite	Green Belt Boat Basin	2872989.49	416222.06	139.40	Black silty sand
LGR-139.5E2	Lower Granite	Green Belt Boat Basin	2873002.71	416060.88	139.50	Black/grey silty clay
LGR-139.5E1	Lower Granite	Green Belt Boat Basin	2873011.90	415985.12	139.50	NS – middle of boat dock
LGR-141.9Al	Lower Granite	Swallows Beach	2871675.65	403995.00	141.90	Black/grey silty sand with 1-4" cobbles
LGR-142.0Bl	Lower Granite	Swallows Beach	2871593.11	403047.68	142.00	NS – Cobbles
LGR-142.1Al	Lower Granite	Swallows Beach	2871356.28	402861.08	142.10	Black/grey silty clay

Table A-1. 2000 sediment sampling locations and material composition (continued).

Sample Site Name	Pool Location	Location Name	Approx WA State Plane Easting NAD27	Approx WA State Plane Northing NAD27	River Mile	Composition
CLW-O.OD	Lower Granite	Lewiston/Clarkston	2873810.50	417539.50	0.00	Gray/brown silty sand
CLW-0.3C	Lower Granite	Lewiston/Clarkston	2874874.30	417554.00	0.30	Brown/grey course sand
CLW-0.5B	Lower Granite	Lewiston/Clarkston	2875901.90	417720.40	0.50	NS – 1-2" cobble
CLW-0.7B	Lower Granite	Lewiston/Clarkston	2876777.50	417662.50	0.70	Cobbles, wood debris
CLW-0.9B	Lower Granite	Lewiston/Clarkston	2877826.80	417503.30	0.90	Brown/grey course sand
CLW-l.IC	Lower Granite	Lewiston/Clarkston	2878333.40	416989.50	1.10	Brown course sand
CLW-l.3C	Lower Granite	Lewiston/Clarkston	2879317.60	416540.90	1.30	Brown/grey course sand
CLW-1.4C	Lower Granite	Lewiston/Clarkston	2880149.80	416128.40	1.40	"
CLW-1.4B	Lower Granite	Lewiston/Clarkston	2880265.60	416316.50	1.40	"
CLW-1.6D	Lower Granite	Lewiston/Clarkston	2881039.90	415520.50	1.60	NS – No recovery
CLW-1.6C	Lower Granite	Lewiston/Clarkston	2881112.30	415686.90	1.60	Brown course sand
CLW-l.IB	Lower Granite	Port of Lewiston	2878442.00	417170.50	1.10	Brown/grey course sand
CLW-l.3A	Lower Granite	Port of Lewiston	2879476.80	416837.60	1.30	Brown course sand
CLW-l.3B	Lower Granite	Port of Lewiston	2879426.20	416743.50	1.30	"

Table A-2: List of proposed sediment sampling sites

Area	Station ID Name	Sample Site Name	Approx WA State Plane Easting NAD27	Approx WA State Plane Northing NAD27	Approx River Mile
Swallows Beach	SWBL21A2	LGR142.1A2	2871407.50	403051.47	142.0
	SWBL21A3	LGR142.1A3	Duplicate and Blank		
	SWBL20B2	LGR142.0B2	2871652.57	403097.74	142.0
	SWB19A1	LGR141.9A1	2871675.65	403995.00	141.8
	SWB19A2	LGR141.9A2	2871659.71	404586.23	141.8
Greenbelt Boat Basin	GBB95E2A	LGR139.5E2A	2873002.71	416060.88	139.5
	GBB95E2B	LGR139.5E2B	Duplicate and Blank		
	GBB94E1	LGR139.4E1	2872988.45	416141.57	139.4
	GBB94E2	LGR139.4E2	2872991.74	416221.01	139.4
	GBB94E3	LGR139.4E3	2872966.83	416436.49	139.4
	GBB93E4	LGR139.3E4	2873054.18	416745.12	139.3
	GBB93E1	LGR139.3E1	2872898.55	416595.36	139.3
	GBB93E2	LGR139.3E2	Duplicate and Split		
Snake River Near Confluence	SRBC91XA	LGR139.1XA	2872368.20	417408.26	139.1
	SRBC91XB	LGR139.1XB	Duplicate		
	SRBC91H	LGR139.1H	2872504.56	417587.68	139.1
	SRBC91G	LGR139.1G	2872597.85	417759.92	139.1
	SRBC91F	LGR139.1F	2872719.86	417975.22	139.1
	SRBC89X	LGR138.9X	2871270.16	417903.45	138.9
	SRBC89H	LGR138.9H	2871377.81	418075.69	138.9
	SRBC89G	LGR138.9G	2871506.99	418290.99	138.9
	SRBC89F	LGR138.7F	2870107.54	418018.28	138.7
	SRBC87E	LGR138.7E	2870164.95	418276.64	138.7
	SRBC87D	LGR138.7D	2870243.89	418570.88	138.7
	SRBC84G1	LGR138.4G1	2868729.61	417924.98	138.4
	SRBC84G2	LGR138.4G2	Duplicate and Split (no Dioxin on split)		
	SRBC84F	LGR138.4F	2868743.96	418111.58	138.4
	SRBC84E	LGR138.4E	2868772.67	418355.58	138.4
	SRBC81F1	LGR138.1F1	2867582.58	417966.48	138.1
	SRBC81F2	LGR138.1F2	Duplicate and Blank		
	SRBC81E	LGR138.1E	2867525.77	418184.69	138.1
	SRBC81D	LGR138.1D	2867466.51	418420.17	138.1
Clearwater River Near Confluence	CLW14C	CLW1.4C	2880149.80	416128.40	1.4
	CLW14B	CLW1.4B	2880265.60	416316.50	1.4
	CLW13C1	CLW1.3C1	2879317.60	416540.90	1.3
	CLW13C2	CLW1.3C2	Duplicate and Blank		
	CLW13B	CLW1.3B	2879426.20	416743.50	1.3
	CLW11C	CLW1.1C	2878333.40	416989.50	1.1
	CLW11B	CLW1.1B	2878442.00	417170.50	1.1
	CLW09B	CLW0.9B	2877826.80	417503.30	0.9
	CLW17B	CLW0.7B	2876777.50	417662.50	0.7
	CLW15B2	CLW0.5B2	2875925.33	417619.78	0.5

Table A-2: List of proposed sediment sampling sites (continued)

Area	Station ID Name	Sample Site Name	Approx WA State Plane Easting NAD27	Approx WA State Plane Northing NAD27	Approx River Mile
Clearwater River (cont)	CLW03C	CLW0.3C	2874874.30	417554.00	0.3
	CLW00D	CLW0.0D	2873810.50	417539.50	0.0
Port of Lewiston	POL13A	CLW1.3A	2879744.39	416747.36	1.3
	POL12A	CLW1.2A	2879180.05	417019.76	1.2
	POL11A	CLW1.1A	2878592.09	417309.24	1.1
Port of Clarkston	POC89J	LGR138.9J	2871223.02	417712.57	138.9
(Gateway Dock)	POC89K	LGR138.9K	2871459.10	417642.70	138.9
(Grain Terminal)	POC84X	LGR138.4X	2869103.28	417886.88	138.4
	POC84H	LGR138.4H	2868859.27	417890.74	138.4
(Crane Dock)	POC79A	LGR137.9A	2866252.05	417504.68	137.9
	POC79B	LGR137.9B	2866463.57	417550.62	137.9
RM-116 Disposal Site	RM1168A	LGR116.8A	2802472.62	470054.21	116.6
	RM1167A1	LGR116.7A1	2802155.30	469910.32	116.6
	RM1166A1	LGR116.6A1	2801756.90	470204.89	116.6
	RM1166A2	LGR116.6A2	Duplicate, blank and split (no dioxin on split)		
Lower Granite Approach	LGOLA4	LGOLA4	2767900.07	501193.24	106.9
	LGOLA3	LGOLA3	2769921.65	499926.55	107.2
	LGOLA1	LGOLA1	2768848.82	500596.89	107.0
Illia Boat Landing	IBL7J1A	LGO103.7J1A	2760160.14	511801.29	103.7
	IBL7J1B	LGO103.7J1B	Duplicate and blank		
	IBL7J3	LGO103.7J3	2760227.60	511828.26	103.7
Willow Boat Landing	WBL9X1A	LGO87.9X1A	2690542.84	504200.79	87.9
	WBL99X2A	LGO87.9X2A	2690461.59	504151.34	87.9
	WBL9X2B	LGO87.9X2B	Duplicate, split, and blank		
	WBL9X3A	LGO87.9X3A	2690265.98	504245.44	87.9
Lower Monumental Approach	HLDLA4	HLDLA4	2490447.58	450769.06	41.3
	HLDLA3	HLDLA3	2492919.39	453036.99	41.5
	HLDLA1	HLDLA1	2491767.10	452131.31	41.4
Ice Harbor Approach	IHNLA8	IHNLA8	2383032.93	331033.03	9.0
	IHNLA7A	IHNLA7A	2384314.03	332365.23	9.1
	IHNLA7B	IHNLA7B	Duplicate		
	IHNLA6	IHNLA6	2385694.56	333088.83	9.1
	IHNLA5	IHNLA5	2386798.36	333617.61	9.2
	IHNLA4	IHNLA4	2387975.89	333933.45	9.3
	IHNLA3	IHNLA3	2387908.16	334149.09	9.4
	IHNLA2	IHNLA2	2390498.33	334537.75	9.5
	IHNLA1	IHNLA1	2408838.93	338795.45	9.5

Appendix B

Chemical Parameters

Table B-1. Chemical parameter groups for the regular samples, equipment blanks, and split samples for each station/ sample site.

Area	Station ID Name	Sample Site Name	Sieve	TVS	NH3	Tier II B[1]	TPH,Oil, Grease[2]	PAH's[2]	Dioxin Screen[3]	Dioxin[3]	TOC	Equip Blank	Split
Swallows Beach	SWBL21A2	LGR142.1A2	X	X	X	X	X	X			X		
	SWBL21A3	LGR142.1A3	X	X	X	X	X	X			X	X	
	SWBL20B2	LGR142.0B2	X	X	X	X					X		
	SWB19A1	LGR141.9A1	X	X	X	X					X		
	SWB19A2	LGR141.9A2	X	X	X	X	X	X			X		
Greenbelt Boat Basin	GBB95E2A	LGR139.5E2A	X	X	X	X	X	X			X		
	GBB95E2B	LGR139.5E2B	X	X	X	X	X	X			X	X	
	GBB94E1	LGR139.4E1	X	X	X	X	X	X			X		
	GBB94E2	LGR139.4E2	X	X	X	X					X		
	GBB94E3	LGR139.4E3	X	X	X	X					X		
	GBB93E4	LGR139.3E4	X	X	X	X					X		
	GBB93E1	LGR139.3E1	X	X	X	X	X	X			X		
	GBB93E2	LGR139.3E2	X	X	X	X	X	X			X		X
Snake River Near Confluence	SRBC91XA	LGR139.1XA	X	X	X	X					X		
	SRBC91XB	LGR139.1XB	X	X	X	X					X		
	SRBC91H	LGR139.1H	X	X	X	X					X		
	SRBC91G	LGR139.1G	X	X	X	X					X		
	SRBC91F	LGR139.1F	X	X	X	X					X		
	SRBC89X	LGR138.9X	X	X	X	X			X	X	X		
	SRBC89H	LGR138.9H	X	X	X	X			X	X	X		
	SRBC89G	LGR138.9G	X	X	X	X			X	X	X		
	SRBC89F	LGR138.7F	X	X	X	X			X	X	X		
	SRBC87E	LGR138.7E	X	X	X	X			X	X	X		
	SRBC87D	LGR138.7D	X	X	X	X			X	X	X		
	SRBC84G1	LGR138.4G1	X	X	X	X			X	X	X		
	SRBC84G2	LGR138.4G2	X	X	X	X			X	X	X		X (no dioxin)
	SRBC84F	LGR138.4F	X	X	X	X			X	X	X		
	SRBC84E	LGR138.4E	X	X	X	X			X	X	X		
	SRBC81F1	LGR138.1F1	X	X	X	X			X	X	X		
	SRBC81F2	LGR138.1F2	X	X	X	X			X	X	X	X	
	SRBC81E	LGR138.1E	X	X	X	X			X	X	X		
	SRBC81D	LGR138.1D	X	X	X	X			X	X	X		

Table B-1. Chemical parameter groups for the regular samples, equipment blanks, and split samples for each station/ sample site (cont).

Area	Station ID Name	Sample Site Name	Sieve	TVS	NH3	Tier II B[1]	TPH, Oil Grease[2]	PAH's[2]	Dioxin Screen[3]	Dioxin[3]	TOC	Equip Blank	Split
Clearwater River Near Confluence	CLW14C	CLW1.4C	X	X	X	X					X		
	CLW14B	CLW1.4B	X	X	X	X					X		
	CLW13C1	CLW1.3C1	X	X	X	X					X		
	CLW13C2	CLW1.3C2	X	X	X	X					X	X	
	CLW13B	CLW1.3B	X	X	X	X					X		
	CLW11C	CLW1.1C	X	X	X	X					X		
	CLW11B	CLW1.1B	X	X	X	X					X		
	CLW09B	CLW0.9B	X	X	X	X					X		
	CLW17B	CLW0.7B	X	X	X	X					X		
	CLW15B2	CLW0.5B2	X	X	X	X					X		
	CLW03C	CLW0.3C	X	X	X	X					X		
	CLW00D	CLW0.0D	X	X	X	X					X		
Port of Lewiston	POL13A	CLW1.3A	X	X	X	X	X	X			X		
	POL12A	CLW1.2A	X	X	X	X	X	X			X		
	POL11A	CLW1.1A	X	X	X	X	X	X			X		
Port of Clarkston	POC89J	LGR138.9J	X	X	X	X	X	X			X		
	POC89K	LGR138.9K	X	X	X	X	X	X			X		
	POC84X	LGR138.4X	X	X	X	X	X	X			X		
	POC84H	LGR138.4H	X	X	X	X	X	X			X		
	POC79A	LGR137.9A	X	X	X	X	X	X	X	X	X		
	POC79B	LGR137.9B	X	X	X	X	X	X			X		
RM-116 Disposal Site	RM1168A	LGR116.8A	X	X	X	X					X		
	RM1167A1	LGR116.7A1	X	X	X	X			X	X	X		
	RM1166A1	LGR116.6A1	X	X	X	X			X	X	X		
	RM1166A2	LGR116.6A2	X	X	X	X			X	X	X	X	X (no dioxin)
L. Granite Approach	LGOLA4	LGOLA4	X										
	LGOLA3	LGOLA3	X										
	LGOLA1	LGOLA1	X										
Illia Boat Landing	IBL7J1A	LGO103.7J1A	X	X	X	X	X	X			X		
	IBL7J1B	LGO103.7J1B	X	X	X	X	X	X			X	X	
	IBL7J3	LGO103.7J3	X	X	X	X					X		

Table B-1. Chemical parameter groups for the regular samples, equipment blanks, and split samples for each station/ sample site (cont).

AREA	STATION ID NAME	SAMPLE SITE NAME	SIEVE	TVS	NH3	TIER II B[1]	TPH, OIL, GREASE[2]	PAH'S[2]	DIOXIN SCREEN[3]	DIOXIN[3]	TOC	EQUIP BLANK	SPLIT
WILLOW BOAT LANDING	WBL9X1A	LGO87.9X1A	X	X	X	X	X	X			X		
	WBL99X2A	LGO87.9X2A	X	X	X	X	X	X			X		
	WBL9X2B	LGO87.9X2B	X	X	X	X	X	X			X	X	X
	WBL9X3A	LGO87.9X3A	X	X	X	X	X	X			X		
LOWER MONUMENTAL APPROACH	HLDLA4	HLDLA4	X										
	HLDLA3	HLDLA3	X										
	HLDLA1	HLDLA1	X										
ICE HARBOR APPROACH	IHNLA8	IHNLA8	X										
	IHNLA7A	IHNLA7A	X	X	X	X					X		
	IHNLA7B	IHNLA7B	X	X	X	X					X		
	IHNLA6	IHNLA6	X										
	IHNLA5	IHNLA5	X	X	X	X					X		
	IHNLA4	IHNLA4	X										
	IHNLA3	IHNLA3	X	X	X	X					X		
	IHNLA2	IHNLA2	X										
	IHNLA1	IHNLA1	X										

[1] Includes: metals (EPA 6010B); semi-volatiles, PCBs, PAHs, pesticides and herbicides (EPA 8270C), pesticides (EPA 8141), herbicides (EPA 8151), carbamate and urea pesticides (EPA 8325/8318), mercury (EPA 7471A), and arsenic (EPA 7470/7171).

[2] Oil, grease, and TPH's in boat basins, port areas, and turning areas for tugs.

[3] Dioxin screen/ analyses are for samples in Lower Granite pool in the vicinity of the diffuser near the confluence and at the RM 116 disposal site.

Appendix C

Field Data Sheet

EXAMPLE FIELD CHECKLIST FORM

FIELD CHECKLIST FOR DREDGE SEDIMENT SAMPLING	1. PROJECT IDENTIFICATION NAME AND CODE	2. SAMPLE SITE NAME

SAMPLER NAME	3A.	3B.
SAMPLER NAME	4A.	4B.
SAMPLER NAME	5A.	5C.
BOAT OPERATOR	6A.	6B.

7. DATE TIME GROUP		8. WEATHER CONDITIONS	9. WIND CONDITIONS
DATE	TIME		

DGPS COORDINATES	10. NORTHING	11. EASTING	12. DATUM	13. P-Dop

14. SAMPLING DEVICE	15. SPUD DEPTH:	16. LENGTH OF CORES:	17. NUMBER OF CORE USED FOR THE COMPOSITE:
SHIPPEK ☐ 2 INCH BALCHEK ☐ 3 INCH BALCHEK ☐ 3 INCH GRAVITY ☐ PHOTO NUMBER_____ COMPOSITE YES ☐ NO ☐	WATER DEPTH:	_____, _____, _____, _____	

18. PRIMARY SAMPLE TYPE:

COBBLE ☐ PHOTO TAKEN? YES ☐ NO ☐

GRAVEL ☐ IS SAMPLE STRATIFIED? YES ☐ NO ☐

SAND ☐ MULTIPLE CORE COMPOSITE? YES ☐ NO ☐

SILT ☐ SUITABLE FOR LAB CHEMICAL ANALYSIS? YES ☐ NO ☐

19. DECONTAMINATION

WAS IT DECON BEFORE USE? YES ☐ NO ☐

WASHED ON SITE WITH WATER? YES ☐ NO ☐

20. SAMPLE CASE NARATIVE (PROBLEMS, DEVIATIONS, EQUIPMENT FAILURES, SAMPLE PHYSICAL DESCRIPTION)

ARAMETER (S) FOR LAB ANALYSIS	METHOD USED FOR ANALYSIS	CONTAINER TYPE AND QUANTITY	INDIVIDUAL SAMPLE CONTAINER SERIAL NUMBERS			
			SAMPLE	BLANK	DUPE	SPLIT
SIEVE ANALYSIS						
AMMONIA, NO_2+NO_3 TVS, TOC						
OIL & GREASE TPH						
DIOXIN						
DIOXIN SCREEN						
ARSENIC & 21 TAL METALS						
MERCURY						
TIER 2 ☐ 3 ☐						

12. THIS FORM DOCUMENT #	13. CHAIN OF CUSTODY FORM NUMBERS	14. DATE SHIPPED

Appendix D

Laboratory QA/QC

Table D-1. Laboratory methods, storage conditions, and holding times for the sediment samples.

PARAMETER	METHOD	STORAGE CONDITIONS	HOLDING TIME	HOLD TIME AFTER EXTRACTION
Ammonia	ASA 31-3	refrigerate at 4°C	14 days	28 days
Arsenic	EPA 7060A	refrigerate at 4°C	6 months	N/A
Dioxin	EPA 8290	refrigerate at 4°C, store in dark	30 days to extract	45 days
Dioxin Screen	EPA 4425	freeze at –20 °C	N/A	N/A
Carbamates	EPA 8318	refrigerate at 4°C, store in dark	7 days	40 days
Chlorinated Herbicides	EPA 8151A	refrigerate at 4°C, store in dark	14 days	40 daya
Mercury (total)	EPA 7471A	refrigerate at 4°C	28 days	N/A
Metals (TAL)	EPA 6010B	refrigerate at 4°C	6 months	N/A
Nitrate + Nitrite	ASA 31-6	refrigerate at 4°C	48 hrs	28 days
Oil and Grease	EPA 9070/ 1664A	refrigerate at 4°C	28 days	N/A
Organophosphorus, organochlorine, and organonitrogen pesticides plus PCB's as arochlors and PAHs	EPA 8270 MOD	refrigerate at 4°C, store in dark	14 days to extract	40 days
Organophosphorus pesticides	EPA 8141	refrigerate at 4°C	14 days to extract	40 days
Sieve Analysis	ASTM D422	refrigerate at 4°C	6 months	N/A
TPH - DRO	EPA 8015B	refrigerate at 4°C, store in dark	14 days	N/A
Total Organic Carbon	EPA 9060	refrigerate at 4°C	28 days	N/A
Total volatile solids	SM 2540G	refrigerate at 4°C	7 days	N/A
Urea Pesticides by HPLC/MS	EPA 8325	Refrigerate at 4 °C	7 days	30 days

Table D-2. Instrument Detection Limits

ASA METHOD D-422
PERCENT BY WEIGHT BY PERCENT PASSING U.S. NUMBERED SIEVE GRAVIMETRIC

Precision is based on accuracy of the equipment used to measure after drying. The lab will supply certificates of calibration for all equipment used in the gravimetric analysis. Additionally supply the standard QA/QC from the SOP of this analysis

ASA METHOD 29-2.3
TOTAL CARBON BY WET COMBUSTION METHOD

Use laboratory method development established curve and QA/QC requirements.

ASA METHOD 31-3
KJELDAHL METHOD DIGESTION WITH COLORMETRIC FINISH USING PHENATE METHOD

Nitrogen as ammonia minimum instrument detection limit: 0.07 mg/L

The ammonia must be factored to take into account the total digestion that includes organic nitrogen as the sum of nitrate, nitrite and ammonia. This is why the lab will analyze for all three species with nitrite/nitrate combined by cadmium reduction.

ASA METHOD 31-6
PERMANGANATE REDUCED IRON MODIFICATION TO INCLUDE NITRITE AND NITRATE WITH COLORMETRIC FINISH USING CADMUIM REDUCTION MEHTOD.

Nitrogen as nitrite/nitrate minimum instrument detection limit: 0.05 mg/L

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 6010B
INDUCTIVELY COUPLED PLASMA-ATOMIC EMISSION SPECTROMETRY

RECOMMENDED WAVELENGTHS AND ESTIMATED INSTRUMENTAL DETECTION LIMITS

Element	Wavelength (nm)	Detection Estimated IDL(b) (µg/L)
Aluminum	308.215	30
Antimony	206.833	21
Arsenic	193.696	35
Barium	455.403	0.87
Beryllium	313.042	0.18
Cadmium	226.502	2.3
Chromium	267.716	4.7
Cobalt	228.616	4.7
Copper	324.754	3.6
Iron	259.940	4.1
Lead	220.353	28
Lithium	670.784	2.8
Magnesium	279.079	20
Manganese	257.610	0.93
Mercury	194.227 x 2	17
Molybdenum	202.030	5.3
Nickel	231.604 x 2	10
Selenium	196.026	50
Silver	328.068	4.7
Strontium	407.771	0.28
Thallium	190.864	27
Tin	189.980 x 2	17
Titanium	334.941	5.0
Vanadium	292.402	5.0
Zinc	213.856 x 2	1.2

(a) The wavelengths listed (where x2 indicates second order) are recommended because of their sensitivity and overall acceptance. Other wavelengths may be substituted (e.g., in the case of an interference) if they can provide the needed sensitivity and are treated with the same corrective techniques for spectral interference (see Section 3.1). In time, other elements may be added as more information becomes available and as required.

(b) The estimated instrumental detection limits shown are provided as a guide for an instrumental limit. The actual method detection limits are sample dependent and may vary as the sample matrix varies.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 7061A
ARSENIC (ATOMIC ABSORPTION, GASEOUS HYDRIDE)

ATOMIC ABSORPTION CONCENTRATION RANGES

	Direct Aspiration		Furnace Procedure (a &c)
	Detection Limit		Sensitivity Detection Limit
Metal	(mg/L)	(mg/L)	(ug/L)
Arsenic	0.002	--	1 (b)

(a) For furnace sensitivity values, consult instrument operating manual.

(b) Gaseous hydride method.

(c) The listed furnace values are those expected when using a 20-uL injection and normal gas flow, except in the cases of arsenic and selenium, where gas interrupt is used.

EPA METHOD 7471A
MERCURY IN SOLID OR SEMISOLID WASTE (MANUAL COLD-VAPOR TECHNIQUE)

METHOD PERFORMANCE DATA

	Laboratory Replicates
Emission control dust:	12 ug/g
Wastewater treatment sludge:	28 ug/g

EPA METHOD 8015 (SCREENING)
TOTAL PETROLEUMHYDROCARBON BY GAS CHRMATORGARPHY USING GC/FID DETECTOR

Analyte	Detection Limits (ppm)	Reporting Limits Soil (mg/kg)	Water (ug/ml)
DRO-1 as Diesel (C10-C28)	20.0	10.0	0.20
DRO-2 (C10-C28)	20.0	10.0	0.20
DRO-3 Total Extractable Organics (TEO)	20.0	10.0	0.20

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8290
POLYCHLORINATED DIBENZODIOXINS (PCDD) AND POLYCHLORINATED DIBENZOFURANS(PCDF)BY HIGH-RESOLUTION GAS CHROMATOGRAPHY/HIGH-RESOLUTION MASS SPECTROMETRY (HRGC/HRMS)

The following compounds will be determined by this method:

Compound Name	CAS Number
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1746-01-6
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	40321-76-4
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	57653-85-7
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	39227-28-6
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	19408-74-3
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	35822-39-4
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3268-87-9
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	51207-31-9
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	57117-41-6
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	57117-31-4
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	57117-44-9
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	72918-21-9
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	70648-26-9
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	60851-34-5
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	67562-39-4
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	55673-89-7
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	39001-02-0

Soil & Sediment Matrices, Sample Sizes and 2,3,7,8-TCDD-Based Method Calibration Limits (Parts per Trillion)

Lower MCL	1.0
Upper MCL	200
Weight (g)	10
IS Spiking Levels (ppt)	100
Final Extr. Vol. (µL)	10-50

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8318
N-METHYLCARBAMATES BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY (HPLC)

The following compounds will be determined by this method:

Compound Name	CAS No.
Aldicarb (Temik)	116-06-3
Aldicarb Sulfone	1646-88-4
Aldicarb sulfoxide	(metabolite)
Aminocarb	2032-59-9
Bendiocarb	22781-23-3
Carbaryl (Sevin)	63-25-2
Carbofuran (Furadan)	1563-66-2
Chlorpropham	101-21-3
Dioxacarb	6988-21-2
Diuron	330-54-1
Fenuron	101-42-8
Fluometuron	2164-17-2
3-Hydroxycarbofuran	16655-82-6
Linuron	330-55-2
Methiocarb (Mesurol)	2032-65-7
Methomyl (Lannate)	16752-77-5
Monuron	150-68-5
Neburon	555-37-3
Oxamyl	23135-22-0
Promecarb	2631-37-0
Propham	2631-37-0
Propoxur (Baygon)	114-26-1
Siduron	1982-49-6
Swep	1918-18-9

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8318 (continued)

RETENTION TIMES AND SINGLE OPERATOR METHOD DETECTION LIMITS

Compound	Retention Time (min)	Organic-free Reagent Water (µg/L)	Soil (a) (µg/kg)
Aldicarb Sulfone	9.59	1.9	44 (b)
Methomyl (Lannate)	9.59	1.7	12
3-Hydroxycarbofuran	12.70	2.6	10 (b)
Dioxacarb	13.50	2.2	>50 (b)
Aldicarb (Temik)	16.05	9.4	12 (b)
Propoxur (Baygon)	18.06	2.4	17
Carbofuran (Furadan)	18.28	2.0	22
Carbaryl (Sevin)	19.13	1.7	31
Methiocarb (Mesurol)	22.56	3.1	32
Promecarb	23.02	2.5	17

(a) MDL for organic-free reagent water, sand, soil are determined by analyzing 10 low concentration spike replicate for each matrix type (except where noted).

(b) MDL determined by analyzing 7 spiked replicates.

Compound	Estimation PQL ug/Kg
Aldicarb sulfoxide	100
Aminocarb	100
Bendiocarb	100
Chlorpropham	100
Diuron	100
Fenuron	100
Fluometuron	100
Linuron	100
Monuron	100
Neburon	100
Oxamyl	100
Promecarb	100
Propham	100
Siduron	100
Swep	100

The lab will determine the best detection limits based on method guidelines for obtaining MDLs. The calculated MDL by the lab or estimated PQL shall be determined with a signal to noise ratio of greater than two. Provide data used to develop the MDL/PQL and provide the summary information of the laboratory established limits.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8151A

CHLORINATED HERBICIDES BY GC USING METHYLATION OR PENTAFLUOROBENZYLATION DERIVATIZATION

Specifically, Method 8151 may be used to determine the following compounds:

Compound	CAS Number
2,4-D	94-75-7
2,4-DB	94-82-6
2,4-D, ethylhexyl ester	1928-43-4
2,4,5-TP (Silvex)	93-72-1
2,4,5-T	93-76-5
2,4,5-T, butyl ester	93-79-8
2,4,5-T, butoxyethanol ester	1929-73-3
Dacthal (DCPA)	1861-32-1
Dalapon	75-99-0
Dicamba	1918-00-9
Dichloroprop	120-36-5
Dinoseb	88-85-7
MCPA	94-74-6
MCPP	93-65-2
4-Nitrophenol	100-02-1
Pentachlorophenol	87-86-5
Acifluorfen	50594-66-6
Bentazon	25057-89-0
Chloramben	133-90-4
DCPA diacid	2136-79-0 b (metabolite)
3,5-Dichlorobenzoic acid	51-36-5
5-Hydroxydicamba	7600-50-2
Picloram	1918-02-1

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8151A (continued)

ESTIMATED METHOD DETECTION LIMITS FOR
DIAZOMETHANE DERIVATIZATION

	Aqueous	Soil Samples	
Compound	GC/ECD Estimated Detection (µg/L) Limit	GC/ECD Estimated Detection (µg/kg)Limit	GC/MS Estimated Identification Limit (ng) a b c
Acifluorfen	0.096	-	-
Bentazon	0.2	-	-
Chloramben	0.093	4.0	1.7
2,4-D	0.2	0.11	1.25
Dalapon	1.3	0.12	0.5
2,4-DB	0.8	-	-
DCPA diacid	0.02	-	- e
Dicamba	0.081	-	-
3,5-Dichlorobenzoic acid	0.061	0.38	0.65
Dichloroprop	0.26	-	-
Dinoseb	0.19	-	-
5-Hydroxydicamba	0.04	-	-
MCPP	0.09	66	0.43 d
MCPA	0.056	43	0.3 d
4-Nitrophenol	0.13	0.34	0.44
Pentachlorophenol	0.076	0.16	1.3
Picloram	0.14	-	-
2,4,5-T	0.08	-	-
2,4,5-TP	0.075	0.28	4.5

(a) EDL = estimated detection limit; defined as either the MDL, or a concentration of analyte in a a sample yielding a peak in the final extract with signal-to-noise ratio of approximately 5, whichever value is higher.

(b) Detection limits determined from standard solutions corrected back to 50-g samples, extracted and concentrated to 10 mL, with 5 µL injected. Chromatography using narrow-bore capillary column, 0.25 µm film, 5% phenyl/95% methyl silicone.

(c) The minimum amount of analyte to give a Finnigan INCOS FIT value of 800 as the methyl derivative vs. the spectrum obtained from 50 ng of the respective free acid herbicide.

(d) From Method 1658, "The Determination of Phenoxy-Acid Herbicides in Municipal and Industrial Wastewater", Methods for the Determination of Nonconventional Pesticides in Municipal and Industrial Wastewater, EPA-821-R-93-010-A, the USEPA Office of Water, Engineering and Analysis Division. MDLs were obtained with an electrolytic conductivity detector.

(e) DCPA monoacid and diacid metabolites included in method scope; DCPA diacid metabolite used for validation studies. DCPA is a dimethyl ester.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C
SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

The following compounds can be determined by this method:

Compounds	CAS No		3510	3520	3541	3550	3580
Acenaphthene	83-32-9	X	X	X	X	X	
Acenaphthene-d (IS)		X	X	X	X	X	
Acenaphthylene	208-96-8	X	X	X	X	X	
Anthracene	120-12-7		(lab determined)				
Acetophenone	98-86-2	X	ND	ND	ND	X	
Alachlor	15972-60-8		(lab determined)				
Aldrin	309-00-2		X	X	X	X	X
Anilazine	101-05-3		X	ND	ND	ND	X
Anthracene	120-12-7		X	X	X	X	X
Aramite	140-57-8		HS	ND	ND	ND	X
Aroclor 1016	12674-11-2		X	X	X	X	X
Aroclor 1221	11104-28-2		X	X	X	X	X
Aroclor 1232	11141-16-5		X	X	X	X	X
Aroclor 1242	53469-21-9		X	X	X	X	X
Aroclor 1248	12672-29-6		X	X	X	X	X
Aroclor 1254	11097-69-1		X	X	X	X	X
Aroclor 1260	11096-82-5		X	X	X	X	X
Azinphos-methyl	86-50-0	HS	ND	ND	ND	X	
Barban	101-27-9		LR	ND	ND	ND	LR
Benzidine	92-87-5	CP	CP	CP	CP	CP	
Benz(a)anthracene	56-55-3	X	X	X	X	X	
Benzo(b)fluoranthene	205-99-2		X	X	X	X	X
Benzo(k)fluoranthene	207-08-9		X	X	X	X	X
Benzo(g,h,i)perylene	191-24-2		X	X	X	X	X
Benzo(a)pyrene	50-32-8 X	X	X	X	X		
Benzyl alcohol	100-51-6		X	X	ND	X	X
α-BHC	319-84-6		X	X	X	X	X
β-BHC	319-85-7		X	X	X	X	X
γ-BHC	319-86-8		X	X	X	X	X
δ-BHC (Lindane)	58-89-9	X	X	X	X	X	
Bis(2-chloroethoxy)methane	111-91-1		X	X	X	X	X
Bis(2-ethylhexyl) phthalate	117-81-7		X	X	X	X	X
Bromoxynil	1689-84-5		X	ND	ND	ND	X
Butyl benzyl phthalate	85-68-7	X	X	X	X	X	
Captafol	2425-06-1		HS	ND	ND	ND	X
Captan	133-06-2		HS	ND	ND	ND	X
Carbaryl	63-25-2	X	ND	ND	ND	X	
Carbofuran	1563-66-2		X	ND	ND	ND	X
Carbophenothion	786-19-6		X	ND	ND	ND	X
Chlordane (NOS)	57-74-9	X	X	X	X	X	
Chlorfenvinphos	470-90-6		X	ND	ND	ND	X

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)
SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

Compounds	CAS No		3510	3520	3541	3550	3580
Chlorobenzilate	510-15-6	X	ND	ND	ND	X	
Chloroneb	2675-77-6		(lab determined)				
2-Chlorophenol	95-57-8	X	X	X	X		
Chloropropylate	5836-10-2		(lab determined)				
Chlorothalonil	1897-45-6		(lab determined)				
Chrysene	218-01-9		X	X	X	X	X
Chrysene-d	(IS)		X	X	X	X	X
Coumaphos	56-72-4	X	ND	ND	ND	X	
Crotoxyphos	7700-17-6		X	ND	ND	ND	X
Dacthal (DCPA)	2136-79-0		(lab determined)				
DBCP	96-12-8		(lab determined)				
4,4'-DDD	72-54-8	X	X	X	X	X	
4,4'-DDE	72-55-9	X	X	X	X	X	
4,4'-DDT	50-29-3	X	X	X	X	X	
Demeton-O	298-03-3		HS	ND	ND	ND	X
Demeton-S	126-75-0		X	ND	ND	ND	X
Diallate (cis or trans)	2303-16-4		X	ND	ND	ND	X
Dibenz(a,j)acridine	224-42-0		X	ND	ND	ND	X
Dibenzo(a,h)anthracene	53-70-3	X	X	X	X	X	
Dibenzo(a,e)pyrene	192-65-4		ND	ND	ND	ND	X
1,2-Dibromo-3-chloropropane	96-12-8	X	X	ND	ND	ND	
Di-n-butyl phthalate	84-74-2	X	X	X	X	X	
Dichlone	117-80-6		OE	ND	ND	ND	X
Dicofol	115-32-2		(lab determined)				
Dichlorovos	62-73-7	X	ND	ND	ND	X	
Dicrotophos	141-66-2		X	ND	ND	ND	X
Dieldrin	60-57-1	X	X	X	X	X	
Diethyl phthalate	84-66-2	X	X	X	X	X	
Dimethyl phthalate	131-11-3		X	X	X	X	X
4,6-Dinitro-2-methylphenol	534-52-1		X	X	X	X	X
2,4-Dinitrophenol	51-28-5	X	X	X	X	X	
Dinocap	39300-45-3		CP,HS	ND	ND	ND	CP
Dinoseb	88-85-7	X	ND	ND	ND	X	
Dioxathion	78-34-2	ND	ND	ND	ND	ND	
Di-n-octyl phthalate	117-84-0		X	X	X	X	X
Disulfoton	298-04-4		X	ND	ND	ND	X
Endosulfan I	959-98-8		X	X	X	X	X
Endosulfan II	33213-65-9		X	X	X	X	X
Endosulfan sulfate	1031-07-8		X	X	X	X	X
Endrin	72-20-8	X	X	X	X	X	
Endrin aldehyde	7421-93-4	X	X	X	X	X	
Endrin ketone	53494-70-5		X	X	ND	X	X

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)
SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

Compounds	CAS No		3510	3520	3541	3550	3580
EPN	2104-64-5		X	ND	ND	ND	X
Ethion	563-12-2		X	ND	ND	ND	X
Ethyl carbamate	51-79-6	DC	ND	ND	ND	X	
Ethyl methanesulfonate	62-50-0	X	ND	ND	ND	X	
Etridiazole	2593-15-9		(lab determined)				
Famphur	52-85-7	X	ND	ND	ND	X	
Fensulfothion	115-90-2		X	ND	ND	ND	X
Fenthion	55-38-9	X	ND	ND	ND	X	
Fluchloralin	33245-39-5		X	ND	ND	ND	X
Fluoranthene	206-44-0		X	X	X	X	X
Fluorene	86-73-7	X	X	X	X	X	
Heptachlor	76-44-8	X	X	X	X	X	
Heptachlor epoxide	1024-57-3		X	X	X	X	X
Hexachlorobenzene	118-74-1		X	X	X	X	X
Hexachlorocyclopentadiene	77-47-4	X	X	X	X	X	
Indeno(1,2,3-cd)pyrene	193-39-5		X	X	X	X	X
Isodrin	465-73-6		X	ND	ND	ND	X
Kepone	143-50-0		X	ND	ND	ND	X
Leptophos	21609-90-5		X	ND	ND	ND	X
Malathion	121-75-5		HS	ND	ND	ND	X
Methoxychlor	72-43-5		X	ND	ND	ND	X
Methyl parathion	298-00-0		X	ND	ND	ND	X
2-Methylphenol	95-48-7		X	ND	ND	ND	X
3-Methylphenol	108-39-4		X	ND	ND	ND	X
Mevinphos	7786-34-7		X	ND	ND	ND	X
Mexacarbate	315-18-4	HE,HS		ND	ND	ND	X
Mirex	2385-85-5		X	ND	ND	ND	X
Monocrotophos	6923-22-4		HE	ND	ND	ND	X
Naled	300-76-5		X	ND	ND	ND	X
Naphthalene	91-20-3		X	X	X	X	X
Naphthalene-d	(IS)		X	X	X	X	X
Nitrobenzene	98-95-3		X	X	X	X	X
Nitrofen	1836-75-5		X	ND	ND	ND	X
Parathion	56-38-2		X	X	ND	ND	X
Permethrin (cis and trans)	52645-53-1		(lab determined)				
Phenanthrene	85-01-8		X	X	X	X	X
Phenanthrene-d	(IS)		X	X	X	X	X
Phorate	298-02-2		X	ND	ND	ND	X
Phosalone	2310-17-0		HS	ND	ND	ND	X
Phosmet	732-11-6		HS	ND	ND	ND	X
Phosphamidon	13171-21-6		HE	ND	ND	ND	X
Pronamide (propyzamide)	23950-58-5		X	ND	ND	ND	X
Propachlor	1918-16-7		(lab determined)				

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)
SEMIVOLATILE ORGANIC COMPOUNDS BY GAS CHROMATOGRAPHY/MASS SPECTROMETRY (GC/MS)

Compounds	CAS No	3510	3520	3541	3550	3580
Pyrene	129-00-0	X	X	X	X	X
Simazine	122-34-9	(lab determined)				
Sulfallate	95-06-7	X	ND	ND	ND	X
Sulfotep (TEDP)	3689-24-5	(lab determined)				
Terbufos	13071-79-9	X	ND	ND	ND	X
Tetrachlorvinphos	961-11-5	X	ND	ND	ND	X
Thionazine	297-97-2	X	ND	ND	ND	X
Toxaphene	8001-35-2	X	X	X	X	X
Trifluralin	1582-09-8	X	ND	ND	ND	X
O,O,O-Triethyl phosphorothioate	126-68-1	X	ND	ND	ND	X

KEY TO ANALYTE LIST

IS = This compound may be used as an internal standard.
surr = This compound may be used as a surrogate.
AW = Adsorption to walls of glassware during extraction and storage.
CP = Nonreproducible chromatographic performance.
DC = Unfavorable distribution coefficient (number in parenthesis is percent recovery).
HE = Hydrolysis during extraction accelerated by acidic or basic conditions (number in parenthesis is percent recovery).
HS = Hydrolysis during storage (number in parenthesis is percent stability).
LR = Low response.
ND = Not determined.
OE = Oxidation during extraction accelerated by basic conditions (number in parenthesis is percent recovery).
OS = Oxidation during storage (number in parenthesis is percent stability).
X = Greater than 70 percent recovery by this technique.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)

Estimated Quantitation Limits

Compound	Soil/Sediment µg/kg
Acenaphthene	660
Acenaphthylene	660
Acetophone	660
Anthracene	660
Benz(a)anthracene	660
Benzo(b)fluoranthene	660
Benzo(k)fluoranthene	660
Benzoic acid	3,300
Benzo(g,h,i)perylene	660
Benzo(a)pyrene	660
Benzyl alcohol	1,300
Bromoxynil	50-200 Lab estimated MDL
Butyl benzyl phthalate	660
Captafol	50-200 Lab estimated MDL
Captan	50-200 Lab estimated MDL
Carbaryl	50-200 Lab estimated MDL
Carbofuran	50-200 Lab estimated MDL
4-Chloroaniline	1,300
4-Chloro-3-methylphenol	1,300
2-Chloronaphthalene	660
2-Chlorophenol	660
Chlordane (alpha)	50-200 Lab estimated MDL
Chlordane (gamma)	50-200 Lab estimated MDL
Chloroneb	50-200 Lab estimated MDL
Chlorofenvinphos	50-200 Lab estimated MDL
Chloropropylate	50-200 Lab estimated MDL
Chlorothalonil	50-200 Lab estimated MDL
Chrysene	660
Coumaphos	50-200 Lab estimated MDL
Crotoxyphos	50-200 Lab estimated MDL
2-Cyclohexyl-4,6-dinitrophenol	50-200 Lab estimated MDL
Demeton-O	50-200 Lab estimated MDL
Demeton-S	50-200 Lab estimated MDL
Dibenzo(a,e)pyrene	50-200 Lab estimated MDL
Di-n-butyl phthalate	50-200 Lab estimated MDL
Dichlone	50-200 Lab estimated MDL
Dichlorovos	50-200 Lab estimated MDL
Dicrotophos	50-200 Lab estimated MDL
Diethyl phthalate	660
7,12-Dimethylbenz(a)anthracene	ND
2,4-Dimethylphenol	660
Dimethyl phthalate	660
4,6-Dinitro-2-methylphenol	3,300 (surrogate ?)

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)

Estimated Quantitation Limits

Compound	Soil/Sediment µg/kg
2,4-Dinitrophenol	3,300
Dinocap	50-200 Lab estimated MDL
Dinoseb	50-200 Lab estimated MDL
Di-n-octyl phthalate	660
Disulfoton	50-200 Lab estimated MDL
EPN	50-200 Lab estimated MDL
Ethion	50-200 Lab estimated MDL
Ethyl carbamate	50-200 Lab estimated MDL
Famphur	ND
Fensulfothion	ND
Fenthion	ND
Fluchloralin	ND
Fluoranthene	660
Fluorene	660
Isodrin	50-200 Lab estimated MDL
Kepone	50-200 Lab estimated MDL
Leptophos	50-200 Lab estimated MDL
Malathion	50-200 Lab estimated MDL
Methoxychlor	ND
3-Methylcholanthrene	ND
4,4'-Methylenebis(2-chloroaniline)	ND
Methyl methanesulfonate	ND
2-Methylnaphthalene	660
Methyl parathion	ND
2-Methylphenol	660
3-Methylphenol	ND
4-Methylphenol	660
Mevinphos	ND
Mexacarbate	ND
Mirex	ND
Monocrotophos	ND
Naled	ND
Naphthalene	660
1,4-Naphthoquinone	ND
1-Naphthylamine	ND
2-Naphthylamine	ND
Nicotine	ND
5-Nitroacenaphthene	ND
2-Nitroaniline	3,300
3-Nitroaniline	3,300
4-Nitroaniline	ND
5-Nitro-o-anisidine	ND
Nitrobenzene	660

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)

Estimated Quantitation Limits

Compound	Soil/Sediment µg/kg
4-Nitrobiphenyl	ND
Nitrofen	ND
2-Nitrophenol	660
4-Nitrophenol	3,300
5-Nitro-o-toluidine	ND
4-Nitroquinoline-1-oxide	ND
N-Nitrosodi-n-butylamine	ND
N-Nitrosodiethylamine	ND
N-Nitrosodiphenylamine	660
N-Nitroso-di-n-propylamine	660
N-Nitrosopiperidine	ND
N-Nitrosopyrrolidine	ND
Octamethyl pyrophosphoramide	ND
4,4'-Oxydianiline	ND
Parathion	ND
Pentachlorobenzene	ND
Pentachloronitrobenzene	ND
Pentachlorophenol	3,300
Phenacetin	ND
Phenanthrene	660
Phenobarbital	ND
Phenol	660
1,4-Phenylenediamine	ND
Phorate	ND
Phosalone	ND
Phosmet	ND
Phosphamidon	ND
Phthalic anhydride	ND
2-Picoline	ND
Piperonyl sulfoxide	ND
Pronamide	ND
Propylthiouracil	ND
Pyrene	660
Pyridine	ND
Resorcinol	ND
Safrole	ND
Strychnine	ND
Sulfallate	ND
Terbufos	ND
1,2,4,5-Tetrachlorobenzene	ND
2,3,4,6-Tetrachlorophenol	ND
Tetrachlorvinphos	ND
Tetraethyl pyrophosphate	ND

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8270C (continued)

Estimated Quantitation Limits

Compound	Soil/Sediment µg/kg
Thionazine	ND
Thiophenol (Benzenethiol)	ND
o-Toluidine	ND
1,2,4-Trichlorobenzene	660
2,4,5-Trichlorophenol	660
2,4,6-Trichlorophenol	660
Trifluralin	ND
2,4,5-Trimethylaniline	ND
Trimethyl phosphate	ND
1,3,5-Trinitrobenzene	ND
Tris(2,3-dibromopropyl) phosphate	ND
Tri-p-tolyl phosphate(h)	ND
O,O,O-Triethyl phosphorothioate	ND

Sample EQLs are highly matrix-dependent. The EQLs listed here are provided for guidance and may not always be achievable. EQLs listed for soil/sediment are based on wet weight. Normally, data are reported on a dry weight basis, therefore, EQLs will be higher based on the % dry weight of each sample. These EQLs are based on a 30-g sample and gel permeation chromatography cleanup.

ND = Not Determined
NA = Not Applicable
NT = Not Tested

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8141A
ORGANOPHOSPHORUS COMPOUNDS BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE

Compound Name	CAS Registry No.
Aspon,	3244-90-4 b
Azinphos-methyl	86-50-0
Azinphos-ethyl	2642-71-9 a
Bolstar (Sulprofos)	35400-43-2
Carbophenothion	786-19-6 a
Chlorfenvinphos	470-90-6 a
Chlorpyrifos	2921-88-2
Chlorpyrifos methyl	5598-13-0 a
Coumaphos	56-72-4
Crotoxyphos	7700-17-6 a
Demeton-O	8065-48-3 c
Demeton-S	8065-48-3 c
Diazinon	333-41-5
Dichlorofenthion	97-17-6 a
Dichlorvos (DDVP)	62-73-7
Dicrotophos	141-66-2 a
Dimethoate	60-51-5
Dioxathion	78-34-2 a,c
Disulfoton	298-04-4
EPN	2104-64-5
Ethion	563-12-2 a
Ethoprop	13194-48-4
Famphur	52-85-7 a
Fenitrothion	122-14-5 a
Fensulfothion	115-90-2
Fonophos	944-22-9 a
Fenthion	55-38-9
Leptophos	21609-90-5 a,d
Malathion	121-75-5
Merphos	150-50-5 c
Mevinphos	7786-34-7 e
Monocrotophos	6923-22-4
Naled	300-76-5
Parathion, ethyl	56-38-2
Parathion, methyl	298-00-0
Phorate	298-02-2
Phosmet	732-11-6 a
Phosphamidon	13171-21-6 a
Ronnel	299-84-3
Stirophos (Tetrachlorovinphos)	22248-79-9
Sulfotep	3689-24-5
TEPP	21646-99-1 d
Terbufos	13071-79-9 a

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8141A (continued)
ORGANOPHOSPHORUS COMPOUNDS BY GAS CHROMATOGRAPHY: CAPILLARY COLUMN TECHNIQUE

Compound Name	CAS Registry No.
Thionazin (Zinophos)	297-97-2 a,b
Tokuthion (Protothiofos)	34643-46-4 b
Tritolyl phosphate (Tech)	
Trichlorfon	52-68-6 a
Trichloronate	327-98-0 b
Industrial Chemicals	
Hexamethylphosphoramide (HMPA)	680-31-9 a
Tri-o-cresylphosphate (TOCP)	78-30-8 a,d
Triazine Herbicides (NPD only)	
Atrazine	1912-24-9 a
Simazine	122-34-9 a

a This analyte has been evaluated using a 30-m column only.
b Production discontinued in the U.S., standard not readily available.
c Standards may have multiple components because of oxidation.
d Compound is extremely toxic or neurotoxic.
e Adjacent major/minor peaks can be observed due to cis/trans isomers.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8141A (continued)

METHOD DETECTION LIMITS IN A WATER AND A SOIL
MATRIX USING 15-m COLUMNS AND A FLAME PHOTOMETRIC DETECTOR

Compound	Reagent Water (3510) (µg/L)	Soil (3540) a b (µg/kg)
Azinphos-methyl	0.10	5.0
Bolstar (Sulprofos)	0.07	3.5
Chlorpyrifos	0.07	5.0
Coumaphos	0.20	10.0
Demeton, -O, -S	0.12	6.0
Diazinon	0.20	10.0
Dichlorvos (DDVP)	0.80	40.0
Dimethoate	0.26	13.0
Disulfoton	0.07	3.5
EPN	0.04	2.0
Ethoprop	0.20	10.0
Fensulfothion	0.08	4.0
Fenthion	0.08	5.0
Malathion	0.11	5.5
Merphos	0.20	10.0
Mevinphos	0.50	25.0
Naled	0.50	25.0
Parathion, ethyl	0.06	3.0
Parathion, methyl	0.12	6.0
Phorate	0.04	2.0
Ronnel	0.07	3.5
Sulfotepp	0.07	3.5
TEPP	0.80	40.0 c
Tetrachlorovinphos	0.80	40.0
Tokuthion (Protothiofos)	0.07	5.5 c
Trichloronate	0.80	40.0 c

(a) Sample extracted using Method 3510, Separatory Funnel Liquid-Liquid Extraction.

(b) Sample extracted using Method 3540, Soxhlet Extraction.

(c) Purity of these standards not established by the EPA Pesticides and Industrial Chemicals Repository, Research Triangle Park, NC.

Table D-2. Instrument Detection Limits (continued).

EPA METHOD 8325
SOLVENT EXTRACTABLE NONVOLATILE COMPOUNDS BY HIGH PERFORMANCE LIQUID CHROMATOGRAPHY/PARTICLE BEAM/MASS SPECTROMETRY (HPLC/PB/MS)

Compound	CAS Number
Benzidine	92-87-5
Benzoylprop ethyl	33878-50-1
Carbaryl	63-25-2
o-Chlorophenyl thiourea	5344-82-1
3,3'-Dichlorobenzidine	91-94-1
3,3'-Dimethoxybenzidine	119-90-4
3,3'-Dimethylbenzidine	612-82-8
Diuron	330-54-1
Linuron (Lorox)	330-55-2
Monuron	150-68-5
Siduron	1982-49-6

ACCURACY AND PRECISION DATA FROM SEVEN DETERMINATIONS OF THE TARGET COMPOUNDS IN ORGANIC-FREE REAGENT WATER USING SOLID-PHASE EXTRACTION (C CARTRIDGE)

Compound	True Conc. (µg/L)	Mean Observed Conc. (µg/L)	Std. Dev. (µg/L)	RSD (%)	Mean Accuracy (% of True)	MDL (µg/L)
Benzidine	22.9	12.2	1.7	13.7	53.2	5.3
Benzoylprop ethyl	32.5	29.3	2.0	6.9	90.2	6.3
Caffeine	14.4	6.4	1.4	21.4	44.2	4.4
Carbaryl	56.6	53.9	1.8	3.3	95.2	5.7
o-Chlorophenyl thiourea	32.6	0.0	0.0	0.0	0.0	*
3,3'-Dichlorobenzidine	5.0	4.4	0.4	10.0	89.6	1.4
3,3'-Dimethoxybenzidine	31.6	25.5	1.8	7.1	80.8	5.7
3,3'-Dimethylbenzidine	31.7	31.4	1.0	3.1	99.0	3.0
Diuron	25.0	24.4	1.4	5.6	97.6	4.4
Ethylene thiourea	32.0	0.0	0.0	0.0	0.0	*
Linuron	95.0	88.9	4.8	5.4	93.6	15.1
Monuron	31.2	30.5	2.9	9.6	97.8	9.1
Siduron	27.9	24.8	2.0	7.9	88.9	6.3

Table D-2. Instrument Detection Limits (continued).

STANDARD METHODS 2540G
TOTAL VOLATILE SOLDS GRAVIMETRIC

Precision is based on accuracy of the equipment used to measure the loss after drying. The lab will supply certificates of calibration for all equipment used in the gravimetric analysis. Additionally supply the standard QA/QC from the SOP of this analysis

Table D-3. Laboratory quality control samples

PARAMETER	BLANK	RREPLICATE	TRIPLICATE	MATRIX SPIKE	CRM	SURROGATES
Ammonia	1 per batch	5% min. per batch	N/A	1 per batch	1 per batch	N/A
Arsenic	1 per batch	5% min. per batch	N/A	5% min. per batch	1 per batch	N/A
Carbamates	1 per batch	10% min per batch	N/A	10% MS/MDS per batch	N/A	NO
Chlorinated herb.	1 per batch	5% min. per batch	N/A	10% per batch	N/A	YES
Dioxin	1 per batch	5% min. per batch	N/A	1 per batch	SPCC	1 per batch (PFK)
Dioxin screen	N/A	See method text	N/A	See method text	N/A	N/A
Mercury	1 per batch	5% min. per batch	N/A	5% min. per batch	1 per batch	N/A
Metals	1 per batch	5% min. per batch	N/A	5% MS/MDS per batch	10% per batch	N/A
$NO_2 + NO_3$	1 per batch	5% min. per batch	N/A	1 per batch	1 per batch	N/A
Oil and Grease	1 per batch	5% min. per batch	N/A	1 per batch	as available	N/A
Organophosphorus, organochlorine, and organonitrogen pesticides plus PCB's as arochlors and PAHs	1 per batch	5% min. per extraction batch	N/A	5% min. MS/DMS per extraction batch	1 per extraction batch, SPCC required	yes
Sieve analysis	N/A	N/A	5% min. per batch	N/A	as available	N/A
TPH - DRO	1 per batch	5% min. per batch	N/A	1 MS/MDS/ batch	N/A	YES
TOC	1 per batch	N/A	5% min. per batch	N/A	1 per batch	N/A
TVS	1 per batch	N/A	5% min. per batch	N/A	N/A	N/A
Urea pesticides	1 per batch	10% min per batch	N/A	10% MS/MDS	N/A	NO

One batch represents a maximum of 20 samples or less.
CRM = Certified Reference Material. A blank spike may be used if a CRM is unavailable.
SPCC = System performance check compounds are required. These are used for QC – see method for details, but usually one per 12 hrs of instrument use.
MS/MDS = Matrix spike/ matrix duplicate spike.
NOTE: It is not possible to spike all pesticide and PCB compounds in to the same sample and obtain useful recovery information. Suspected contaminant target compounds will be used for this spike.

Table D-4. Chemistry acceptance limits for the sediment samples

PARAMETER	LAB REPLICATE	MATRIX SPIKE	DUP MATRIX SPIKE	BLANK SPIKE	CRM	METHOD BLANK
Ammonia	20% RSD	75 – 125%	80 – 120%	75 – 125%	75 – 125%	< MDL
Arsenic	≤35% RSD	75 – 125%	N/A	80 – 120%	80 – 120%	< MDL
Carbamates	<30% RSD	70 – 130%	80 – 120%	80 – 120%	80 – 120% (e)	<MDL
Chlorinated herb.	<30% RSD	70 – 130%	N/A	80 – 120%		<MDL
Dioxin	≤20% RSD	40 – 135%	40 – 135%	N/A	80 – 120%	See method
Dioxin Screen	See method	N/A	N/A	N/A	N/A	< MDL
Mercury	<20% RPD	75 – 125%	75 – 125%	90 – 110%	90 – 110%	<MDL
Metals (b)	< 35% RPD	75 - 125%	N/A	80 - 120%	80 – 120%	< MDL
$NO_2 + NO_3$	<20% RPD	90 – 110%	80 – 120%	75 – 125%	75 – 125%	< MDL
Oil and Grease	≤100% RPD	50 - 150%	50% RPD	N/A	80 - 120%	< MDL
Organophosphorus, organochlorine, and organonitrogen pesticides plus PCB's as arochlors and PAHs (8270C)	≤100% RPD	1 per class per batch (see text)	N/A	70 – 130%	80 - 120%	< MDL
Sieve analysis	≤35% RSD (d)	N/A	N/A	N/A	Sieves conform to ASTM	N/A
TPH - DRO	<25%	50 – 150%	50 – 150%	50 – 150% (e)	75 – 125%	< MDL
TOC	≤35% RSD	N/A	N/A	N/A	80 - 120%	< MDL
TVS	≤35% RSD	N/A	N/A	N/A	N/A	< MDL
Urea pesticides		70 – 130%		80 – 120%	80 – 120%	< MDL

(a) EPA 8270 list
(b) Metals = Priority Pollutant Metals
(c) Surrogate recoveries must be between 50% and 150%
(d) Within average % by weight of triplicate QA/QC sample
(e) If concentration falls within 1.70-2.30 mg/L then the limits are ±15% of value.
(f) Surrogate recovery within 50-150%

RPD = Relative Percent Difference N/A = Not Analyzed or Not applicable
RSD = Relative Standard Deviation MDL = Method Detection Limit
SPCC = System performance check compounds

Table D-5. Summary of laboratory data qualifiers

CONDITION TO QUALIFY	DATA QUALIFIER	ORGANICS QC LIMITS	METALS QC LIMITS	CONVENTIONALS QC LIMITS	COMMENT
Very low matrix spike recovery	X	< 10 %	< 10 %	N/A	
Low matrix spike recovery	G	< 50%	< 75%	N/A	
High matrix spike recovery	L	> 150%	>125%	N/A	
Low SRM recovery	G	< 80%	N/A	< 80%	
High SRM recovery	L	>120%	>120%	>120%	
High duplicate RPD	E	>100 %	>20%	N/A	Use duplicate as routine QC for organics
High triplicate RSD	E	N/A	N/A	> 20 %	Use triplicate as routine QC for conventionals
Less than the reporting detection limit	< RDL	N/A	N/A	N/A	
Less than the method detection limit	< MDL	N/A	N/A	N/A	
Contamination reported in blank	B	> MDL	> MDL	> MDL	
Very biased data, based on surrogate recoveries	X	all fraction surrogates are <10%	N/A	N/A	Use average surrogate recovery for BNA
Biased data, based on low surrogate recoveries	G	all fraction surrogates are < 50%	N/A	N/A	Use average surrogate recovery for BNA
Biased data, based on high surrogate recoveries	L	all fraction surrogates are >150%	N/A	N/A	Use average surrogate recovery for BNA
Estimate based on presumptive evidence	J# used to indicate the presence of TIC's	N/A	N/A	N/A	
Rejected, unusable for all purposes	R	N/A	N/A	N/A	
A sample handling criteria has been exceeded	H	N/A	N/A	N/A	Includes container, preservation, hold time, sampling technique